SC060300 Unit Outline

Biological organization; Particles & Waves; Examining water & Weather

Unit 3: Observing and Measuring Waves and Vibrations

Abstract

Students investigate the motion of vibrating objects as an introduction to waves. They measure the period and amplitude of various vibrations, and calculate the frequency of the vibration. They apply their knowledge to understand many different phenomena in the world around them, including the action of waves on beaches, how sounds reach our ears, and the dangers of earthquakes. In addition to exploring the motion of vibrating objects, students investigate the interactions of light with various materials. The set up reflections, observe refraction, and explain the color of the sky using the concept of scattering. Students are challenged to understand how light is required to see objects.

Lesson 1 – Vibrating Objects (SC060301)
In this first lesson on waves and vibrations, students identify what they already know about vibrating objects, based on the unit *Now Hear This* (SC050300). They experiment with a variety of vibrating objects such as a rubber band guitar and can drum. Using these experiences, students become familiar with the words scientists use to describe the motion of vibrating objects (period, frequency, and amplitude). They apply what they learn about vibrations to thunder, a very big vibration.

Lesson 2 – Observing and Measuring the Motion of Vibrating Objects (SC060302)
Students recall their personal experiences with swings and apply their knowledge to investigate pendulums as examples of vibrating objects. They conduct a scientific investigation, make predictions and observations, and write explanations to describe what they see happening when an object vibrates. Students measure the variables of period, frequency and amplitude using appropriate tools and units of measurement. Finally they describe vibrations using the words period, frequency, and amplitude.

Lesson 3 – Earthquake! (SC060303)
Students apply what they have learned in the first two lessons to earthquakes. Since students know that earthquakes are vibrations in the Earth's crust, they are asked to create models showing the interactions of these vibrations with the buildings, roads and bridges, which people have constructed on the surface of the Earth. These models will show two kinds of vibrations: up and down motion, and back and forth motion. Students predict ways that these objects could be constructed, so they are "earthquake proof."

Lesson 4 – Hit the Beach—Water Waves (SC060304)
Students continue to explore the relationship between waves and vibrations, modeling with ropes, towels, and crepe paper and observe vibrations changing speed and direction. Then they apply what they have learned about vibrations to water waves. Students construct a ripple tank using a baking pan and observe the motion of waves. They observe how waves are reflected off different objects.

Lesson 5 – Sounding Off (SC060305)
Students apply their understanding and prior experience with other types of waves to sound waves. They predict the interactions of sound waves with various materials and then test their predictions to determine which materials will absorb sound and which ones will reflect sound.

Lesson 6 – Measuring Sound Waves and Echoes (SC060306)
Students read about techniques used to map the ocean floor and observe maps that have been created from these data. They conduct tests and calculate the time it takes for a sound to be reflected. Students then apply what they have learned and use SONAR readings to locate the Edmund Fitzgerald in Lake Superior.

Lesson 7 – How Do We Hear a Sound? (SC060307)
Students draw and label the parts of the ear to understand how they hear a sound. Then they draw a flow diagram showing how sound energy travels through the various parts of the ear system to the brain. Students identify the different materials that vibrate and begin to understand why loud sounds can damage their hearing permanently.

Lesson 8 – Seeing the Light (SC060308)
Students examine ways in which light energy acts as a wave. Light can be absorbed, reflected, refracted and scattered. Students experiment with a variety of materials to gain an understanding of these key concepts and three properties of materials: transparent, translucent, and opaque.

Lesson 9 – How Do We See Objects? (SC060309)
Students draw and label parts of the eye to help understand how they see an object. Then they draw a flow diagram showing how light energy travels to an object, is reflected, and then travels through the various parts of the eye to the brain. Finally, students explain what they can do to keep healthy eyes.

Lesson 10 – Waves in Nature (SC060310)
This final lesson on waves and vibrations gives students an opportunity to apply what they have learned to phenomena they may see in nature. They will research a natural light phenomenon, create a three-dimensional model or diagram and present an explanation to the class

Michigan Benchmarks

IV.4.MS.3 Explain how light is required to see objects.
Key Concepts: Light source, object, eye as a detector, illumination, path of light, reflection, absorption. See IV.4.MS.2 (echo location).

Real-World Contexts: Seeing common objects in our environment; seeing "through" transparent media, such as windows, water; using flashlights to see in the dark.

IV.4.MS.4 Describe ways in which light interacts with matter.
Key Concepts: Reflection, refraction, absorption, transmission, scattering, medium, lens. Transmission of light-transparent, translucent, opaque.

Real-World Contexts: Objects that reflect or absorb light, including mirrors; media that transmit light such as clear and frosted glass, clear and cloudy water, clear and smoky air; objects that refract light, including lenses, prisms, and fiber optics; uses of lenses, such as eye, cameras, telescope, microscope, magnifying lens, for magnification and light-gathering.

IV.4.MS.5 Describe the motion of vibrating objects.
Key Concepts: Period, frequency, amplitude.

Real-World Contexts: Vibrating or oscillating objects, such as weights on springs, vocal cords, tuning forks, guitar strings.

IV.4.MS.6 Explain how mechanical waves transfer energy.
Key Concepts: Sound energy, absorption, transmission, reflection; media – air, solids, water. (see IV.1.MS.6, electrical circuits transfer electrical energy.)

Real-World Contexts: Waves in slinkies and long springs, sound waves, water waves, earthquakes.

I.1.MS.4 Use metric measurement devices to provide consistency in an investigation.
Key Concepts: Documentation – laboratory instructions. Measurement units-milliliters, liters, millimeter, centimeter, meter, gram.

Measurement Tools: Balancing devices, measuring tape, thermometer, graduated cylinder.

Real-World Contexts: Conducting investigations, following or altering laboratory instructions for mixing chemicals.

I.1.MS.6 Write and follow procedures in the form of step-by-step instructions, formulas, flow diagrams, and sketches.
Key Concepts: Purpose, procedure, observation, conclusion, data.

Real-World Contexts: Listing or creating the directions for completing a task, reporting on investigations.

National Science Education Standards

CONTENT STANDARD B: As a result of their activities in grades 5-8, all students should develop an understanding of

- Properties and changes of properties in matter
- Motions and forces
- Transfer of energy